

Optimizing Gaming Experiences with a Web-Based Marketplace Peripherals

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Abstracts: Over the past decade, the global gaming peripheral market has emerged as a major investment in world trade. Numerous brands, including Razer and Logitech Inc., strive to make a significant impact and set trends in the industry by offering a wide range of products. These products cater to users' preferences and game system requirements, ranging from off-the-shelf options to fully custom-made gaming peripherals. This paper presents an application blueprint study for a centralized marketplace that compares on-market products from different renowned gaming peripheral producers. By leveraging this research, users can benefit from personalized recommendations for the best products that align with their preferences and game system requirements, ultimately enhancing their gaming experiences.

Keywords: Gaming Peripheral, Gaming Experience, Hardware Requirement, System Requirement, Gamer.

1. INTRODUCTION

1.1. Online Marketplace

The shift from physical stores to online marketplaces has indeed changed the retail landscape significantly. While it is true that some physical retailers have transitioned to selling exclusively through their websites, it doesn't necessarily mean that the wide brand variety has been eliminated. In fact, e-commerce has opened opportunities for a greater overall brands variety to be gathered and offered in one online marketplace.

Online retailers often carry a vast array of products from different brands, allowing customers to explore and choose from a wide range of options. Reported by Similaraweb, these platforms like Amazon, eBay, and other online marketplaces have become popular destinations for consumers looking for a diverse selection of products. These platforms typically have numerous sellers offering products from various brands, providing shoppers with ample choices. Due to the wide range of products from many sellers, the platforms overlooked the concept of providing specific suggestions based on their customer requirements. They only offer general filters to eliminate products based on general purposes.

Currently, existing online marketplaces offer limited technical assistance to their potential or returning customers. Customers must perform some research on the internet to discover different brands and products, read online reviews, engage with social media platforms, and review user feedback to create a more informed shopping experience and make purchasing decisions. After completing their research on separate platforms, customers then return to the online marketplace to proceed with their purchase. This process can be a hassle, especially for technical products such as gaming peripherals. An online marketplace that specifically sells gaming peripherals with advanced technical assistance would make a huge difference.

1.2. Gaming Peripheral Marketplace

Gaming peripherals refer to hardware devices that are specifically created to elevate the gaming experience by enhancing performance, comfort, precision, and functionality during gameplay. These

peripherals are commonly used with gaming consoles, personal computers, or mobile devices. The objective of these devices is to enrich the gaming experience by offering players improved control, precision, immersion, and overall performance while engaging in games (Ke Et. Al., 2019). Meanwhile from the gaming market trend perspective, trends can change over time as technology advances and consumer preferences evolve. For the most up-to-date information on gaming peripheral market trends, it would be advisable to consult recent industry reports, news articles, and market analysis specific to the gaming peripheral industry. Thus, embedding a feature such as technical assistance on a gaming peripheral marketplace platform will surely benefit the customers. Technical assistance can be in feedback and review forms.

From a gaming peripheral online market point of view, it offers wide selection. Online shopping provides access to a vast array of gaming peripherals from different brands and models. Customers can explore various options and compare prices, features, and users reviews to make an informed purchasing decision. Offline stores may have limited stock and selection, while online retailers offer a broader range of products to choose from. Apart from that, it is convenient as online shopping allows browsing and purchasing gaming peripherals from the comfort of the customers' home. There is no need to travel to physical stores, deal with crowds, or adhere to store operating hours. With online shopping, you have the convenience of making purchases anytime, anywhere, if an internet connection is available.

Besides, online retailers often offer competitive pricing for gaming peripherals. You can easily compare prices across multiple websites to find the best deals and discounts. Online platforms also frequently run promotions, flash sales, and exclusive online-only offers, allowing you to save money on your purchases. And due to this, online shopping enables you to compare different gaming peripherals side by side, including their specifications, features, and prices. This makes it easier to find the exact product that meets your requirements and preferences. Offline stores may require visiting multiple locations to compare products, which can be time-consuming.

Moreover, online retailers provide detailed product descriptions, specifications, and compatibility information for gaming peripherals at any time. This information allows customers to understand the features, functionality, and compatibility of the peripheral with the gaming setup, ensuring of making the right choice. On top of these benefits, one more significant advantage of buying gaming peripherals online is the availability of customer reviews and ratings. The customers can read experiences and opinions from other gamers who have already used the product, helping on make an informed decision about the quality and performance of the peripheral before making a purchase.

1.3. Objectives

Igor Dąbrowski proposed that to tackle efficient search, the system must centralize and/ or decentralize. For the proposed system, we opt for a combination of centralize and de centralize approach. We use a centralized approach to narrow the focus on the product type, gaming peripheral. Meanwhile, we use a decentralized method to gather various kinds of brands in one online single marketplace (Dąbrowski, 2020). Following are the objectives of this study:

- Provide an online centralized marketplace by creating an online centralized marketplace exclusively dedicated to gaming peripherals.
- Provide advanced search features' by implementing standardized technical specifications format and curation for customers.
- Allow customers to compare products by conducting cross-brand product comparisons to enhance purchasing experience.

2. RELATED WORKS

This study focuses on two well established websites and among the preferred companies by the gaming community. They are Logitech and Razer Inc. according to Global Gaming Peripherals Market Report from 2018 to 2028. Even though these companies are among the preferred ones, there are still visible downsides to their websites. The identified flaws are discussed in the following subsections with visual attachments from both official websites.

2.1. Lack of a Centralized Marketplace

Based on the official websites, both sites are selling their product exclusively. No other brands are available. Brand wise, this feature will surely benefit its own products and company reputation. But on the other hand, this is limiting products and brands comparisons which is a big hit for the online marketplace. Various well-known brands are not offered on a similar platform for the customers to choose from shown in Figure 1 and Figure 2.



Fig. 1: Screenshot of Razer Malaysia Homepage Displaying Its Product, Razer Hammerhead Pro Hyperspeed and Razer Nommo V2 Line

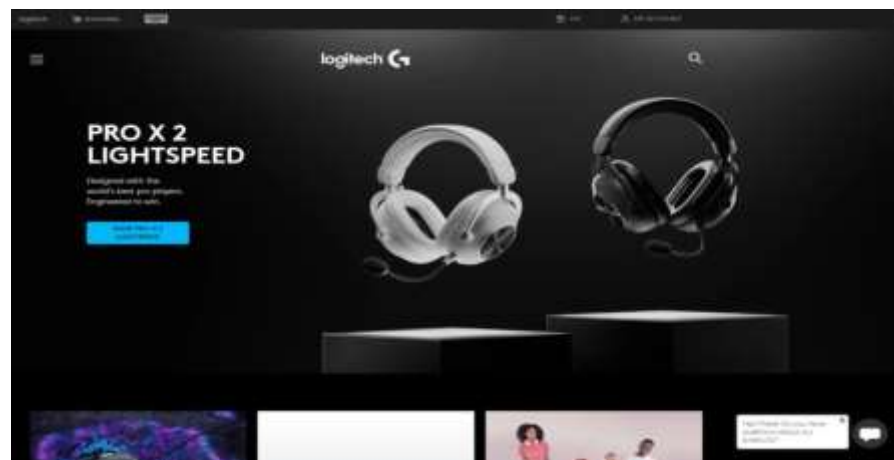


Fig. 2: Screenshot of Logitech Malaysia Webpage Displaying Its Product, Logitech Pro X 2 Lightspeed

For the moment, when it comes to centralized marketplace, the related website not only displays the sale products, but also handles the online purchases. Ecommerce capability. While Razer website has the mentioned feature, Logitech does not. Figure 3 and Figure 4 illustrate the mentioned concern.

For purchasing feature, Logitech Malaysia official website uses third party to manage the e-commerce feature. If a customer would like to buy a product from the Logitech website, the customer must choose whether to place the order on Lazada.com or Shopee.com as shown in Figure 3. Once the customer chooses which e-commerce platform to order from, it will be redirected to the e-commerce webpage. Moreover, the customer will only know whether the product is out of stock after choosing where to place the order. For example, if the customer chose Lazada and the product is out of stock, the customer will be redirected to the Lazada webpage and Out-Of-Stock message will be displayed as shown in Figure 3.

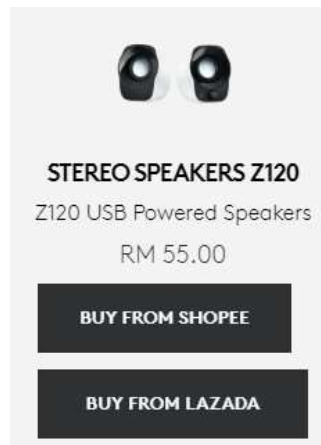


Fig. 3: Screenshot of Available Options for Customer to Buy Logitech Stereo Speakers Z120 from LogitechWebpage

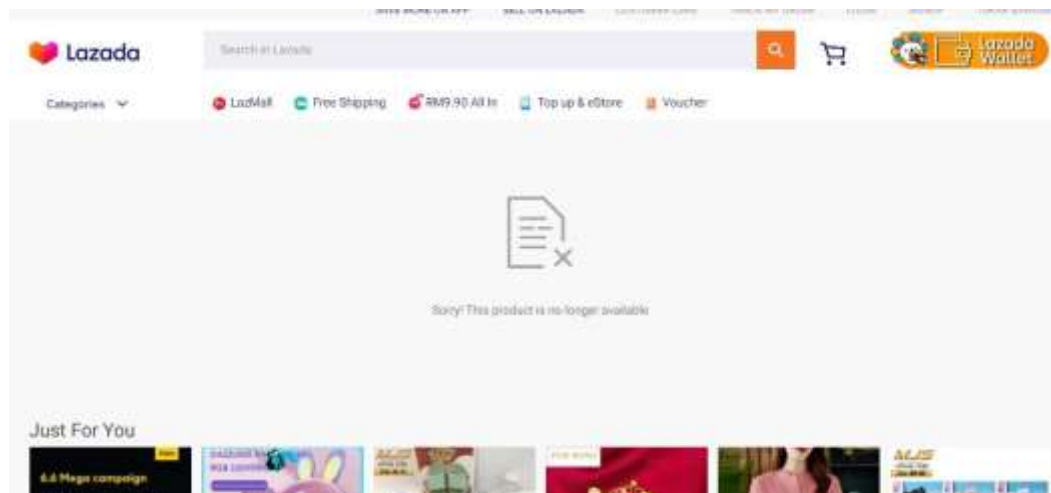


Fig. 4: Screenshot of Out-Of-Stock Message of Lazada Webpage

2.2. Content and Format Inconsistency

Next point is detail inconsistency. There is no standardized format in summarizing the product specification thus leading to content inconsistency. For customers with novice level in gaming peripheral, this will confuse them and might mislead the webpage readers also known as the customers. Figure 5 and Figure 6 show the discussed feature.

RAZER NOMMO V2	
Tech Specs	
DRIVER SIZE	<ul style="list-style-type: none"> • Full-range drivers: 2 x 3" • Down-firing subwoofer driver: 1 x 5.5"
INPUT POWER	External Power Adapter
FREQUENCY RESPONSE	40 Hz – 20 kHz
APPROXIMATE WEIGHT	<ul style="list-style-type: none"> • Speakers (Total): 2.6 kg / 5.73 lbs • Subwoofer: 4.8 kg / 10.58 lbs
DRIVER TYPE	Full-range drivers; subwoofer driver
COMPATIBILITY	<ul style="list-style-type: none"> • Rear projection Razer Chroma™ RGB (2 zones) • THX Spatial Audio • Wired subwoofer • USB audio input • Bluetooth 5.3 • Custom 10-band EQ • Max SPL: 98 dB • Toggle PC audio devices (supported via Razer Synapse)

Fig. 5: Screenshot of Razer Nommo V2 Technical Specification by Razer

Specs & Details	Technical Specifications
<p>Dimensions</p> <p>Satellite (Left and Right)</p> <p>Height: 146.2 mm Width: 89.4 mm Depth: 81 mm Weight: 480 g - total for two satellite speakers</p> <p>Subwoofer</p> <p>Height: 228.4 mm Width: 150 mm Depth: 220 mm Weight: 2.3 kg</p>	<p>Total Watt (RMS): 25 W Subwoofer: 15 W Satellites: 2 x 5 W 3.5 mm input: 1 Headphone Jack: 1 Controls: Power and volume controls on wired control pod</p>

Fig. 6: Screenshot of Z313 Computer Speaker System Specification and Detail by Logitech

Based on the two figures above, they both describe the same type of product, an external computer speaker. However, the content specification from both webpages is inconsistent. For example, in Figure 1635

5, frequency response feature of the offered product is available, 40Hz to 20 KHz. Meanwhile, none of the same features are available from Logitech webpage, Figure 6. This missing information of specification might invite confusion to the customers especially to ones who has little technical knowledge of gaming peripherals. Moreover, peripheral specification formatting differs from site to site thus it can be hard to compare different products as some information may be lacking.

2.3. Limited Cross Brands Comparison Capability

This is another limitation created from selling only self-brand products. The limitation of brands comparison from these two webpages is shown in Figure 7 and Figure 8. Figure 7 is a comparison between Razer Seiren V2 Pro, Razer Seiren V2 X and Razer Seiren Mini. All of them are made by Razer. No other brand available. Meanwhile, Figure 8 demonstrates a comparison between four models of headset by Logitech, H151 Stereo Headset, H370, H540 USB Computer Headset and H390 USB Computer Headset. No other brand is accessible to be compared yet again. In other words, gaming peripherals are spread out across different retailers and going through different websites to browse is troublesome.

	Razer Seiren V2 Pro	Razer Seiren V2 X	Razer Seiren Mini
CAPSULES	30mm Dynamic Capsule	25mm Condenser Capsule	14mm Condenser Capsule
POLAR PATTERNS	Cardioid Pickup Pattern	Supercardioid Pickup Pattern	Supercardioid Pickup Pattern
ELECTRONIC FILTER	High Pass Filter	-	-
LIMITER	Digital Analog Limiter	Digital Analog Limiter	-
CONTROLS	Volume Dial, Gain Dial and Mute Button	Gain Dial and Mute Button	-

Fig. 7: Screenshot of Seiren Series Products Comparison by Razer

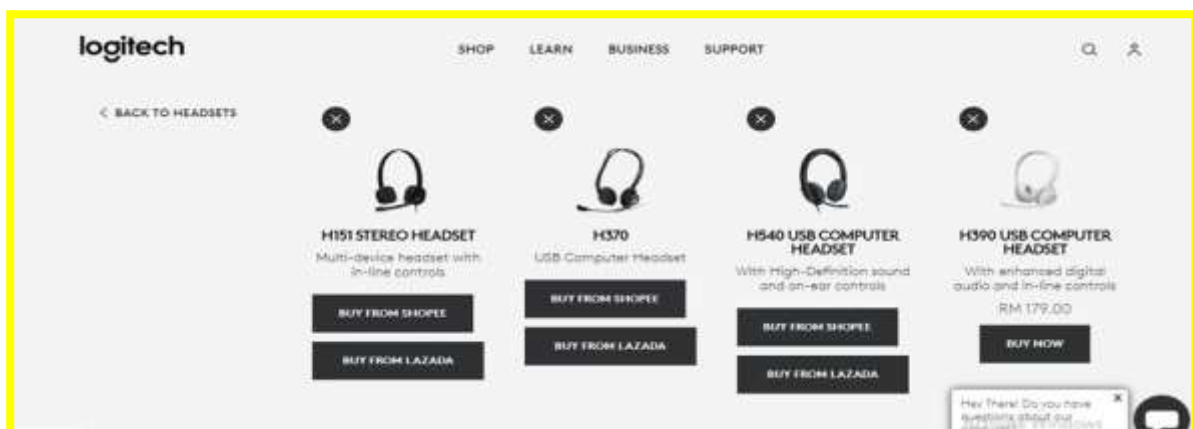


Fig. 8: Screenshot of Headset Models Comparison by Logitech

3. METHODOLOGY

Let's look at Figure 9 the Use Case Diagram of the System. Admin user is the gaming peripheral seller while Customer is the buyer. Both profiles are required to login into the proposed system to use the designed functions. From the admin perspective, admin can manage customer details in the system. This includes adding new customer records, editing existing and deleting customer information. Admin can also administer product details which include adding new products, editing existing and deleting. The admin can view the order details that were placed by the customer through the proposed system. In addition, admin can also access messages and reviews from the customer regarding any related product.

From a customer point of view, customer can view and edit own profile. For comparison features, customer will have full access to all products detail that are stored in the system. This will allow the customer to get as much technical assistance as possible from the system. All products can be selected and compared as long they are from the same type of product. For example, comparing headset from brand A and brand B. Once comparison is complete, customer can add any interested products into the cart and check out when shopping is complete. Removing any item from the cart is also possible. Customer is allowed to leave any message and review regarding any specific product through the proposed system.

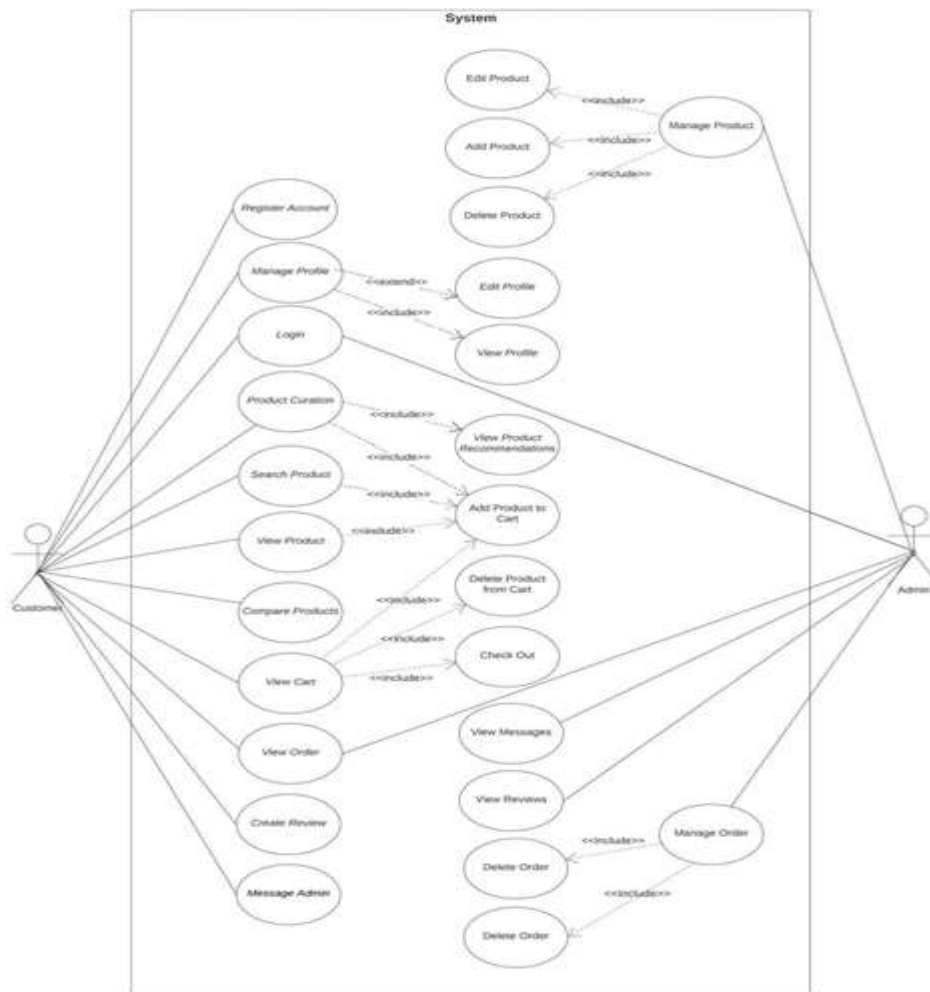


Fig. 9: Use Case Diagram of Gaming Peripheral System

4. RESULTS

This section exhibits the proposed design based on studied goals. Selected webpages will be shown in the next subsections.

4.1. Registration and Login Page

Users need to register to use the system. For authentication purposes, prior to first time login user will be redirected to QR code authenticator page. Users must complete two steps. First scan the QR code followed by enter code from Google Authenticator. During login process, only username and password are required. These processes are displayed in Figure 10, Figure 11 and Figure 12.

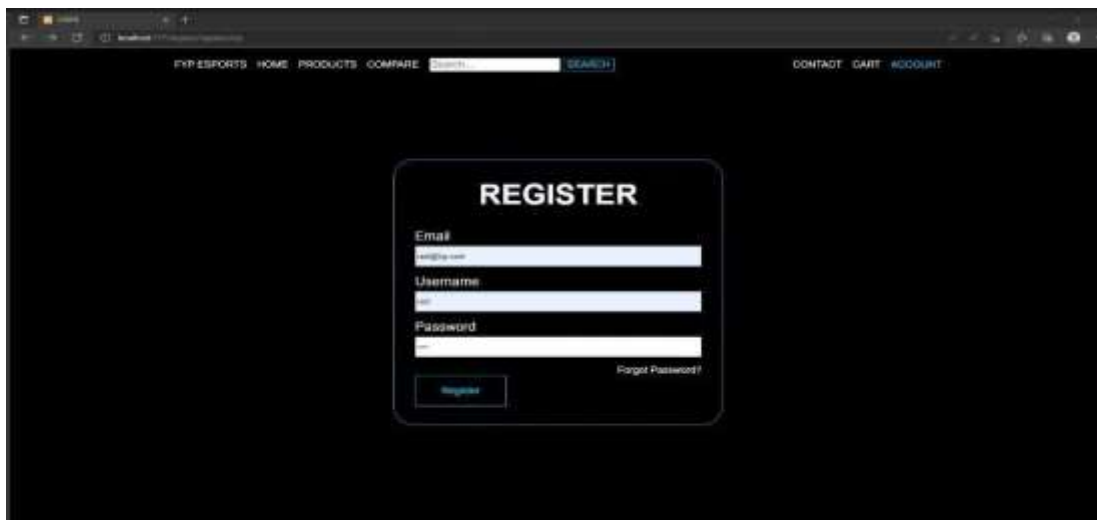


Fig. 10: User Registration Page



Fig. 11: QR Code Authenticator Page



Fig. 12: Login Page

4.2. Product Pages

After login, the user will be greeted with a lively homepage. Presenting the latest in-stock products that are ready to be purchased across multiple well-known brands shown in Figure 13. For the product page two display formats are available. Product page by category and by search in Figure 14 and 15 respectively.

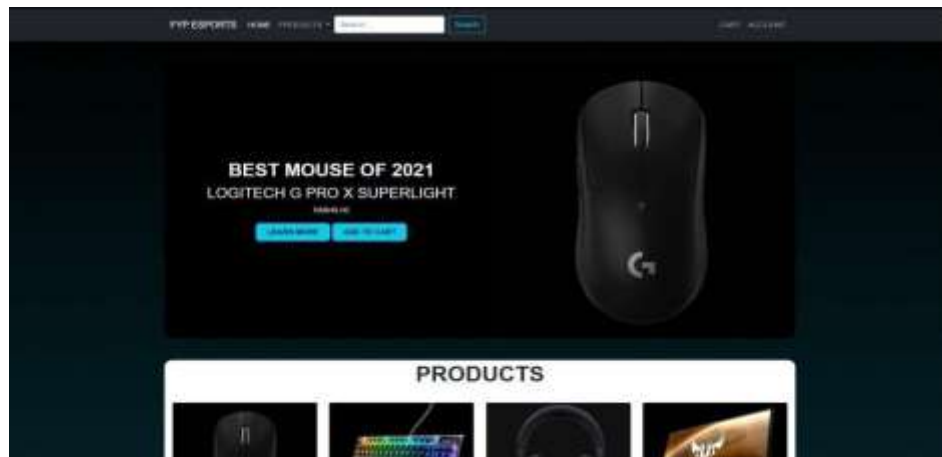


Fig. 13: Website Homepage



Fig. 14: Product Page by Category

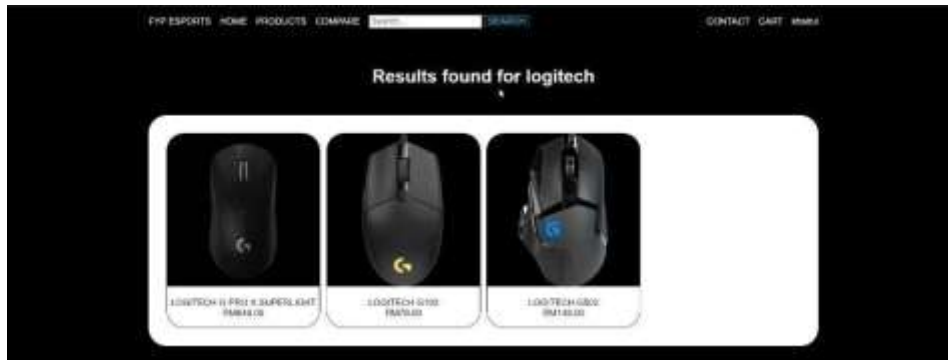


Fig. 15: Product Page by Search



Fig. 16: Product Page

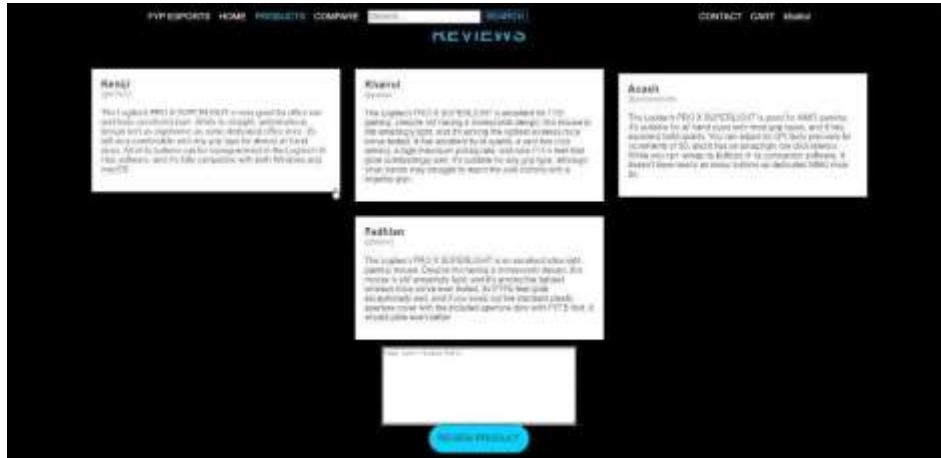


Fig. 17: Review Page

Besides displaying the technical specification of a product in Figure 16, reviews from existing users regarding the related product are also available in Figure 17.

4.3. Curation Page

Advanced technical assistance is available on the curation page as shown in Figure 20. There are a set of questions that the user must answer as diagnostic questions. After that, the system will suggest the most suitable peripheral to the user based on the user gaming preferences.

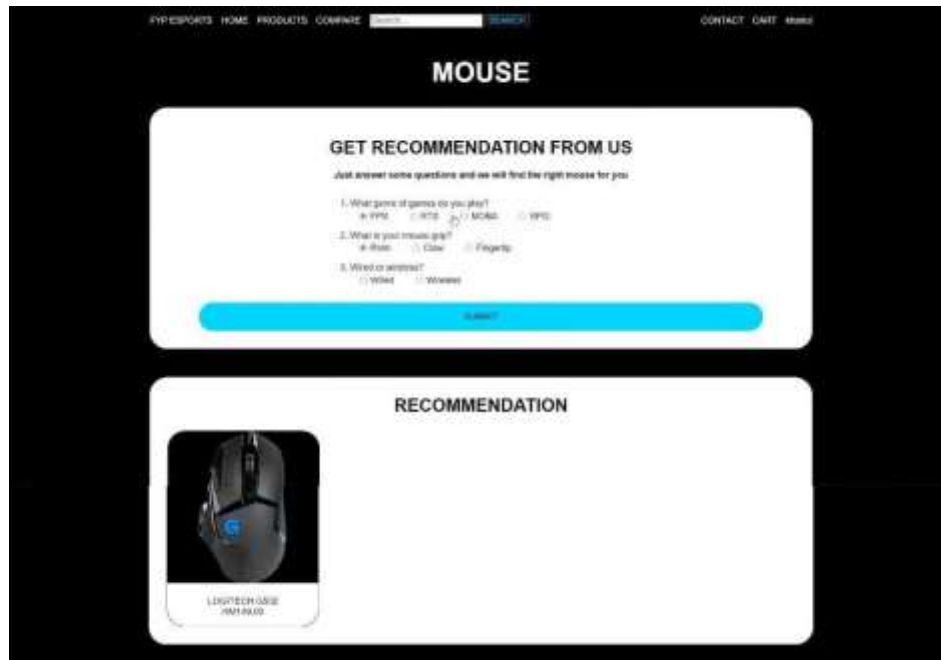


Fig. 18: Curation Page

4.3. Comparison Page

A comparison between similar product types across different brands is available under the comparison page. Figure 19 exhibits a comparison of a gaming mouse from two different brands, Logitech and Razer. The compared features are standardized across multiple brands.



Fig.19: comparison page

4.5. Cart and Checkout Page

For the purchasing process, the user will navigate through cart and checkout pages as illustrated by Figure 20 and Figure 21. In cart, price per unit and cumulative amount are displayed accordingly. Image of the related product is also available. So that the user can double check before checking out. During checkout, users need to fill up the mailing address and credit card information.

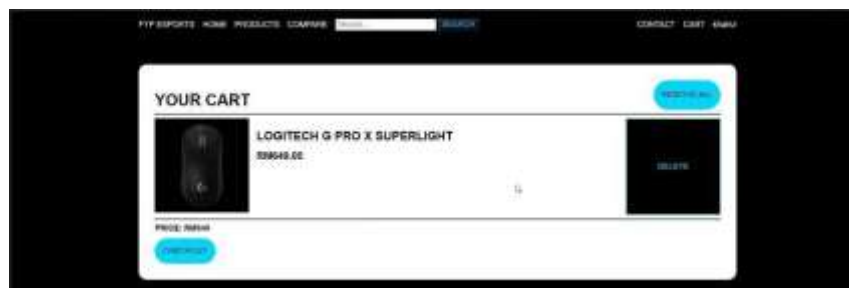


Fig. 20: Cart Page

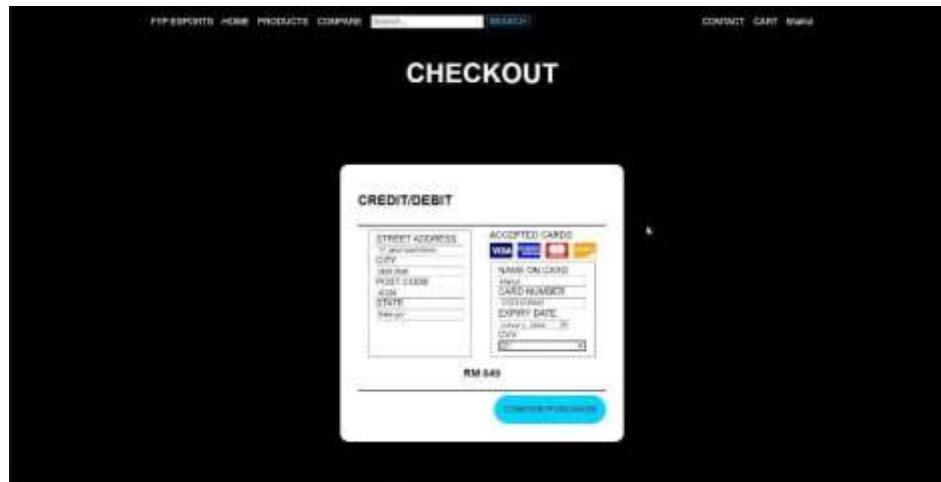


Fig. 21: Checkout Page

4.6. User Pages

Figure 22 and Figure 23 demonstrate the features on user pages. User dashboard was created to ease the user by displaying its purchase summary. So that user can check for latest purchased status as shown in Figure 22. Meanwhile, users are allowed to edit their registered information such as email address, username and password like Figure 23.

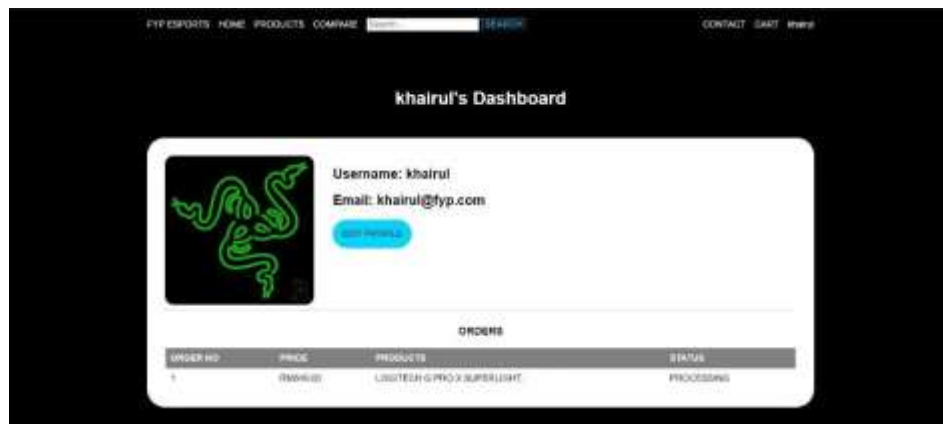


Fig. 22: User Dashboard

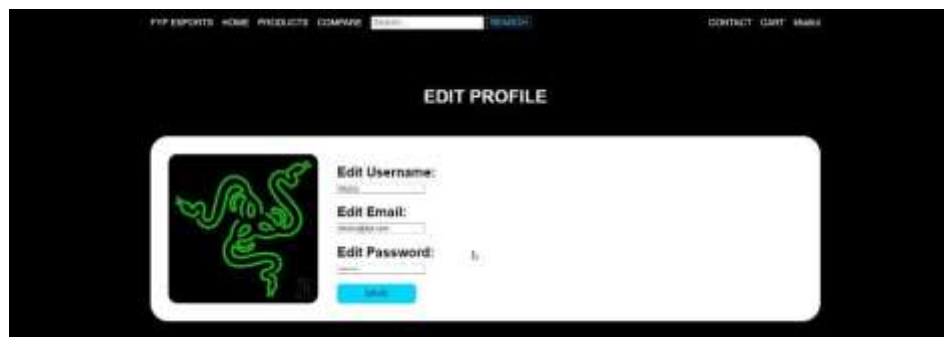


Fig. 23: Edit User Profile

4.7. Contact Us Pages

This system allows users to establish connection with the seller via message. The message is tagged to the user's email. Any response from the seller will be in the user's email inbox.

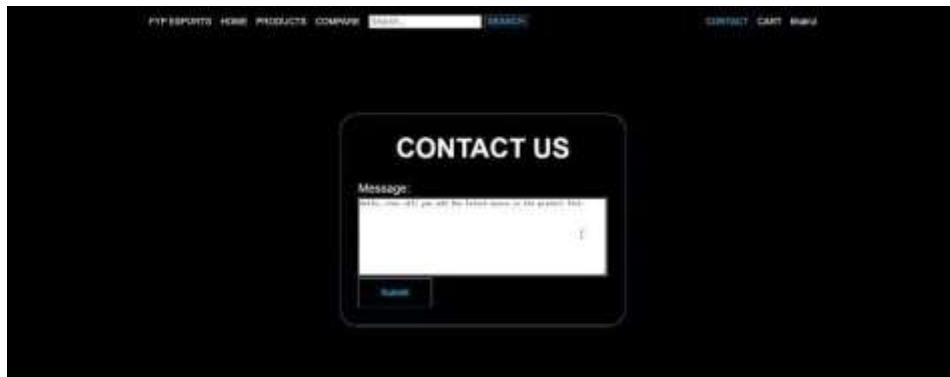


Fig. 24: Contact Us Page

4.8. Admin Pages

Admin dashboard is a summary of latest activities and products management shown by Figure 25. On the top part of the admin dashboard displays recent activities such as orders, registered customers, shared reviews of products and dropped messages. All entries will be assigned a unique ID to avoid any redundancy. Thus, just after the admin login, admin can easily check for recent transactions here. For example, if the admin clicks on the View All Order, the next page to be displayed is Figure 26. All orders are in detail manner compared to the summarized dashboard view. Same navigation process if the admin clicks on View All Customer on the dashboard. It will show Figure 27. Details of customer's profile.

On the bottom part of the admin dashboard in Figure 25 is where the admin manages the products. Admin can simply click on the edit or delete button to perform on any existing products and add button to add new products. Figure 28 shows the add product page. What kind of product information required by the system is pre-set. It is standardized. This pre-set feature may avoid missing information or data redundancy.

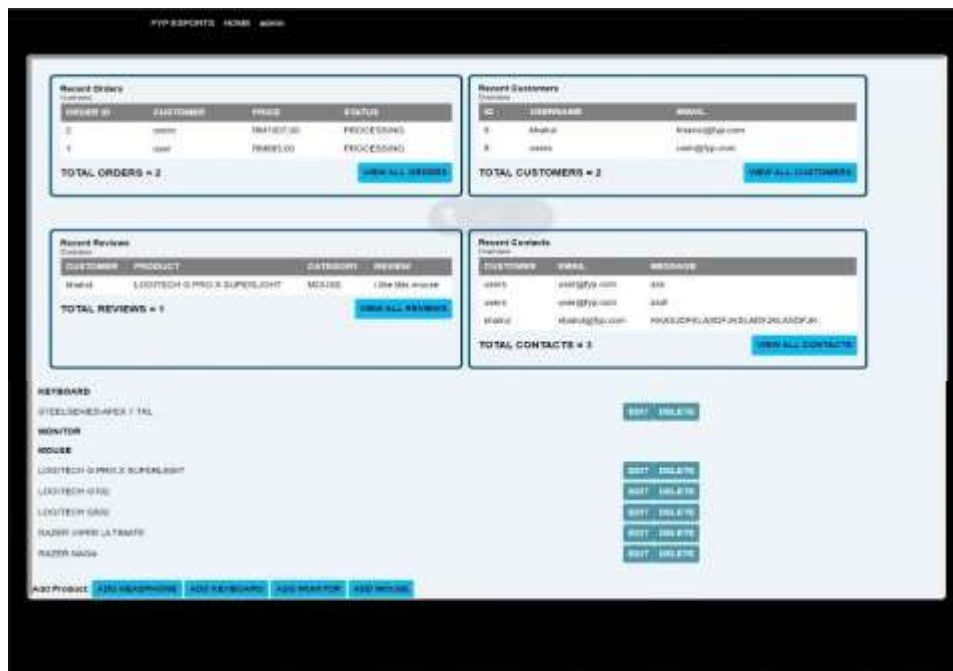


Fig. 25: Admin Dashboard



Fig. 26: View Orders Page



Fig. 27: View Customer Page



Fig. 28: Add Product Page

4.9. System Testing

The proposed system has been tested and the summary is tabulated in Table 1 for user features and Table 2 for admin features.

Table 1. Summary of System Testing for User Features.

TestID	Test Case	Expected Result	Actual Result	Status
1	<u>Login:</u> Enter a valid username and valid password. Click "Login" button.	<ul style="list-style-type: none"> User should be able to login onto the system. The system should display home page with the name of the user. 	<ul style="list-style-type: none"> User can login. Home page with name of user is displayed. 	Pass
2	<u>Login:</u> Enter invalid username and invalid password. Click "Login" button.	<ul style="list-style-type: none"> User should not be able to login to the system. 	<ul style="list-style-type: none"> User could not login. Prompt shows no account with those details. 	Pass
3	<u>Register:</u> Enter email, username, and password.	<ul style="list-style-type: none"> User should be able to register for an account. 	<ul style="list-style-type: none"> User was able to register. 	Pass
4	<u>Register:</u> Enter existing email, username, and password.	<ul style="list-style-type: none"> User should not be able to register for an account. Prompt will appear informing of existing account. 	<ul style="list-style-type: none"> User was not able to register. Prompt appears informing of existing account. 	Pass
5	<u>QR Code Validation:</u> Scan QR code using any authenticator app to gain validation key for account.	<ul style="list-style-type: none"> Users will be able to get a validation key for their account. 	<ul style="list-style-type: none"> Users get validation key. 	Pass
6	<u>Forgot Password:</u> Validate username with key to change password.	<ul style="list-style-type: none"> Password is reset. 	<ul style="list-style-type: none"> Feature not implemented. 	Fail
7	<u>Change Username:</u> Input new username.	<ul style="list-style-type: none"> Username is updated. 	<ul style="list-style-type: none"> Username is updated. 	Pass
8	<u>Change Username:</u> Input same username.	<ul style="list-style-type: none"> Username is not updated. Prompt appears notifying of same username. 	<ul style="list-style-type: none"> Username is updated. No prompt. 	Fail
9	<u>Change Email:</u> Input new email.	<ul style="list-style-type: none"> Email is updated. 	<ul style="list-style-type: none"> Email is updated. 	Pass
10	<u>Change Password:</u> Input new password.	<ul style="list-style-type: none"> Password is updated. 	<ul style="list-style-type: none"> Password is updated. 	Pass
11	<u>Search:</u> Input keywords and search database for matching products.	<ul style="list-style-type: none"> Matching products shown. 	<ul style="list-style-type: none"> Matching products shown. 	Pass
12	<u>Search:</u> Input random string of text and search database for matching products.	<ul style="list-style-type: none"> No products shown. 	<ul style="list-style-type: none"> No products shown. 	Pass
13	<u>Add to Cart:</u> Add product to cart.	<ul style="list-style-type: none"> Product is added to cart. 	<ul style="list-style-type: none"> Product is added to cart. 	Pass

14	<u>Checkout:</u> Checkout and key in payment details to pay for order.	<ul style="list-style-type: none"> Successfully checkout and empty cart. 	<ul style="list-style-type: none"> Checked out and cart is empty. 	Pass
15	<u>Checkout:</u> Checkout without anything in cart.	<ul style="list-style-type: none"> Unable to checkout. 	<ul style="list-style-type: none"> Unable to checkout. 	Pass
16	<u>Checkout:</u> Checkout with invalid payment details.	<ul style="list-style-type: none"> Unable to checkout Prompt notifying of which detail is invalid. 	<ul style="list-style-type: none"> Unable to checkout Prompt appears. 	Pass
17	<u>Track Order:</u> Track order through user dashboard.	<ul style="list-style-type: none"> Order details is shown, including status. 	<ul style="list-style-type: none"> Order details is shown, including status. 	Pass
18	<u>Track Order:</u> Track order through user dashboard without having placed an order.	<ul style="list-style-type: none"> No orders shown. 	<ul style="list-style-type: none"> No orders shown. 	Pass
19	<u>Contact:</u> Write message and send to admin of site.	<ul style="list-style-type: none"> Prompt appears notifying that message has been sent. 	<ul style="list-style-type: none"> No prompt 	Fail
20	<u>Curate:</u> Answer simple questions.	<ul style="list-style-type: none"> Get recommended a product that fits criteria. 	<ul style="list-style-type: none"> Recommended product shown. 	Pass
21	<u>Curate:</u> Give random answers for simple questions.	<ul style="list-style-type: none"> Do not get recommended a product that fits criteria. 	<ul style="list-style-type: none"> No recommended product. 	Pass
22	<u>Compare:</u> Select two products to compare.	<ul style="list-style-type: none"> Two selected products are shown side by side along with technical specifications. 	<ul style="list-style-type: none"> Two selected products are shown side by side along with technical specifications. 	Pass

Table 2. Summary of System Testing for Admin Features.

TestID	Test Case	Expected Result	Actual Result	Status
23	<u>Login:</u> Login using admin details.	<ul style="list-style-type: none"> Logged in as admin. 	<ul style="list-style-type: none"> Logged in as admin. 	Pass
24	<u>View Orders:</u> List down the orders received.	<ul style="list-style-type: none"> Orders are listed. 	<ul style="list-style-type: none"> Orders are listed. 	Pass
25	<u>View Customers:</u> List down customers.	<ul style="list-style-type: none"> Customers are listed. 	<ul style="list-style-type: none"> Customers are listed. 	Pass
26	<u>View Reviews:</u> List down reviews received.	<ul style="list-style-type: none"> Reviews are listed. 	<ul style="list-style-type: none"> Reviews are listed. 	Pass
27	<u>View Contacts:</u> List down contact messages.	<ul style="list-style-type: none"> Contact messages are listed. 	<ul style="list-style-type: none"> Contact messages are listed. 	Pass
28	<u>Add Product:</u> Add new product to system.	<ul style="list-style-type: none"> New product is added. Listed down in product listing. 	<ul style="list-style-type: none"> New product is added. Listed down in product listing 	Pass
29	<u>Add Product:</u> Add new product using existing product details.	<ul style="list-style-type: none"> Product not added. Prompt notifying of existing product. 	<ul style="list-style-type: none"> Product not added. Prompt appears. 	Pass
30	<u>Edit Product:</u> Update new product information.	<ul style="list-style-type: none"> New information is updated in system. 	<ul style="list-style-type: none"> New information is updated in system. 	Pass

31	Delete Product: Delete product from system.	• Product is deleted from system.	• Product is deleted from system.	Pass
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CONCLUSION

A web-based marketplace specifically for gaming peripherals is highly demanded nowadays. A site where all brands get together and available for technical comparison. Furthermore, feedback and reviews from its users are displayed accordingly for potential buyers. The mentioned capabilities allow the proposed system to fulfill its objectives which is providing an online centralized marketplace by creating an online centralized marketplace exclusively dedicated to gaming peripherals from multi-brands. Secondly, provide advanced search features' by standardizing technical specifications format and curation for customers. Lastly allow customers to compare products by enabling cross-brand product comparisons to enhance purchasing experience. By having this system functionality, gaming experience can be optimized through enhanced buying experience of gaming peripherals.

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